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COMPTON GAMMA-RAY OBSERVATORY

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Submitted to:

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Titles of Research:

"Search for Hard X-Ray Emission from Aquila X-1";
"High Energy Emission from Gamma-Ray Radio Star 2CG 135+1/LSI 61 303"

Period Covered by Report:

1 October 1995 – 30 September 1996

July 1996

The investigation consists of different projects carried out during the Cycle 5 GRO observing phase.

- 1. *EGRET, COMPTEL and BATSE studies of unidentified gamma-ray sources.*
  This investigation is carried out in collaboration with the co-investigators: J. Mattox (Maryland), R. Mukherjee (NASA/GSFC) and J. Halpern (Columbia). The BATSE analysis is done in collaboration with N.Zhang (NASA/MSFC). We completed the analysis of GRO phase 4 data on the time variable gamma-ray sources near the Galactic plane: GRO J1021-58, GRO J1813-12, GRO J1828+01. We show that these sources are not associated with radio-loud spectrally flat blazar-like counterparts, and we discussed several models regarding their origin [1,2].

  We serendipitously discovered a remarkable new gamma-ray transient near the Galactic plane, GRO J1838-0145 [3]. We show that the gamma-ray intensity reached a Geminga-like flux in June 1995. Even for this transient, no radio-loud spectrally flat blazar-like counterpart exists in its error box. The existence of strong gamma-ray transients near the plane of the Galaxy might indicate a local population of gamma-ray emitters, and a theoretical discussion is under way [1,3].

- 2. *A GRO study of the gamma-ray source 2CG 135+1.*
  This GRO multi-instrument project is aimed at studying the time variable gamma-ray emission from the unidentified source 2CG 135+1 possibly associated with the peculiar radio counterpart/massive star LSI 61 303. We completed the analysis of multi-instrument GRO phase 3 data, and several papers were submitted [4,5,6,7,8]. A summary of the multiwavelength observations of 2CG 135+1 (including the radio observations at the Green Bank Interferometer [7]) appeared in ref. [9]. Additional Cycle 5 GRO data to be obtained in September 1996 will be processed as they become available. The aim is to achieve, for a first time, a comprehensive view of the spectral and time variability properties of the source from tens of keV to GeV energies. A theoretical model of 2CG 135+1 based on pulsar shock emission is being developed [10].

- 3. *A BATSE study of the hard X-ray emission from X-ray bursters.*
  X-ray bursters are believed to contain neutron stars and they are ideal candidates for studying transient and steady hard X-ray emission from compact objects. We played a leading role in the collaborative work aimed at detecting and interpreting this emission. This work includes P. Kaaret (Columbia), J. Grindlay and D. Barret (Harvard), B.A. Harmon and S.N. Zhang (NASA/MSFC). A complete analysis of BATSE data covering the time 1991-1995 is being completed [11] and a first summary was presented at the GRO Compton Symposium in Munich [12].

The object *Aquila X-1* is of particular importance. We discovered hard X-ray emission from this X-ray burster during the 1991-1994 period [13]. We recently discovered (July 1996) a prominent hard X-ray outburst from Aquila X-1 correlated with soft X-ray and optical emission. Data analysis is in progress.

Hard X-ray emission from neutron stars can reveal the mechanism of particle energization and coronal heating related to accretion disk instabilities or transition states. A theoretical model of hard X-ray emission from Aquila X-1 and similar transients is being developed in collaboration with E. Liang (Rice) [14].

It is also worth mentioning at least two more current investigations that have impact on GRO science.

- 4. *A study of Galactic superluminal X-ray transients.*
  We proposed and obtained a continuous radio monitoring of GRS 1915+105 during the 1995-1996 period at the Green Bank Interferometer. We discovered several prominent radio flares from this source that turn out to be strongly correlated with hard X-ray emission [15]. A theoretical analysis of the emission from GRS 1915+105 and similar transients is being carried out [16,17].

  We observed the nearby superluminal transient GRO J1655-40 with the *Hubble* telescope in April 1995, following a prominent hard X-ray outburst. The aim was to detect or constrain optical emission from outwardly propagating plasmoids. The lack of detection for the April 1995 event establishes the dual nature of hard X-ray outburst, and a theoretical discussion of the results was presented together with the multiwavelength observations from the radio to the hard X-ray band [18].

- 5. *A model of Gamma-Ray Bursts.*
  A new model of gamma-ray burst (GRB) emission is being developed, based on synchrotron emission of impulsively accelerated particles [19,20]. We showed that all the multi-instrument GRO spectra of prominent GRBs agree with the proposed synchrotron model [19,20]. Work is in progress both on the theoretical side [21] and on the data analysis side [22].

References

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